RAFT FOUNDATION ANALYSIS USING MATLAB AND CRYSTAL BALL PROGRAM

Final Project

to complete the requirements to
achieve S-1 graduate degree in Civil Engineering

Prepared by :

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To

CIVIL ENGINEERING DEPARTMENT
ENGINEERING FACULTY
UNIVERSITAS MUHAMMADIYAH SURAKARTA

2014

CERTIFICATION SHEET

RAFT FOUNDATION ANALYSIS USING MATLAB AND CRYSTAL BALL PROGRAM

Final Project

Submitted and defended in Final Examination of
Final Project in front of Board of Examiners
On 13rd November 2014

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PREFACE

Assalamu'alaikum Wr. Wb.

Alhamdulillah, all praise to Allah azza wa jalla who has given blessing and mercies until this Final Project can be completed. This Final Project to complete most the requirement to achieve S-1 graduate degree in Civil Engineering Department, Engineering Faculty, Universitas Muhammadiyah Surakarta. The author also says thanks for all parties who give any support for arrangement this Final Project until it can be completed.

The accomplishment this Final Project the author will say thanks to other parties :

1) Sri Sunarjon,PhD as the Dean of Engineering Faculty of Universitas Muhammadiyah Surakarta.
2) Mohammad Solikin,PhD as Head of Civil Engineering Department of Universitas Muhammadiyah Surakarta.
3) Suhendro Trinugroho as author's academic advisor who has given many suggestion for author's academic.
4) Agus Susanto,S.T,M.T. as major advisor who has guided and taught the author.
5) Anto Budi Listyawan,S.T,M.Sc. as secondary advisor major advisor who has guided and taught the author.
6) Ir. Renaningsih,M.T. as examiner who has given some advices to make this final project better.
7) All lecturers in Civil Engineering Department of Engineering Faculty of Universitas Muhammadiyah Surakarta thanks for your guidance and knowledge.
8) Dad, mom and my beloved family who always give me support. Thanks for your praise and wish a long this time, may Allah give you a reward as well as you give to me.

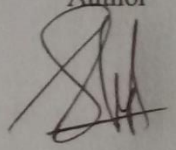
9) All my friends for Civil Engineering International Program period 2010 (Alfia, Nuning, Rasyid, Ghoni, Andi, Rifzal and Tegar), thanks for your time as my partner and for Civil Engineering period 2010, you are the best for me.
10) All parties that cannot be mentioned one by one who have helped to accomplishing this Final Project.

The author realize that the arrangement this Final Project is not a perfect one. Because of that, the author hope there are any suggestion and criticism to make this Final Project better and can be useful for us. Aminnn

Wassalamu`alaikum Wr.Wb.

Surakarta, November 2014

Author



DECLARATION OF AUTHORSHIP

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Declare that this Final Project is made and presented by mine, except the quotations and summaries that I have explained from all of the sources. If at a later it is found that this Final Project is a product of plagiarism, I am willing to accept any legal consequences that may be imposed to me.

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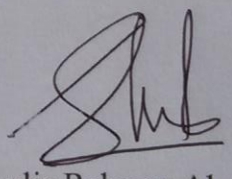

Aulia Rahman Al-Alaby

MOTTO

"And whenever you give your word, say the truth"
(al-An`aam 6:152)

"The only way to have the greatest work in your life
is love what you do first"
(Anonim)

"You are creator for your own future "
(Anonim)

"Idza shodaqol 'azmu wadhohas sabil"
(Mahfudzot)

"Do your own thingking independently
Be the chess player, not the chess piece"
(Anonim)

"Make up one idea. Make that idea on your life
– think of it, dream of it, live on that idea.
Let the brain, muscles, nerves, every part
of your body, be full of that idea,

and just leave every other idea alone.
This is the way to success.
(Swami Vivekananda)

ACKNOWLEDGEMENT

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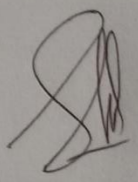

The Writer

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q_c = Tip resistance (kg/m^2)

f_s = Sleeve friction (cm^2)

D_f = Depth (m)

B = Width (m)

Elb = Flexible stiffness of the upper part of the building and raft foundation.

Es = Modulus of elasticity of soil.

H = Height (m)

Elf = Flexible stiffness raft foundation

Q = Total load of columns (kN/m^2)

q = The pressure on the soil (kN/m^2)

A = Width of area (m^2)

Ix = Moment of inertia about the *x*-axis.

Iy = Moment of inertia about the *y*-axis.

My = Moment of the column loads about the *x*-axis.

Mx = Moment of the column loads about the *x*-axis.

L = Length (m)

F = Load modification factor (kN/m^2)

U = Factored column load (MN)

Φ = Reduction factor

$f_c^{'}$ = Compressive strength of concrete at 28 days (MN/m^2).

b_o = The location of the column with respect to the plan of the mat (m).

d = Diameter of column (m).

As = Area of steel per unit width (cm)

Fy = Yield stress of reinforcement in tension

Mu = Factored moment

σ = Standard deviation

x^2 = Chi-square

o_i = frequency observations

e_i = Expected frequency

ABSTRACTION

RAFT FOUNDATION ANALYSIS USING MATLAB AND CRYSTAL BALL PROGRAM

Solo city is a city that is located in central of java, as the result solo city becomes trade center in java island. Furthermore, the position of the town as a solo 3-way intersection of the east of the area east of Java, north of the area and the coast road west of the city of Yogyakarta. This opportunity is needed to make any investment such as hotel. Hotel Anugerah Palace is built on area of 1100 m^2, consists of 9 floors and 1 Basement. The project is scheduled to finish in June 2013. Due to the construction of this hotel, it is located in center of the city and make the access is easy.

This final project analyzes raft foundation using probability and structural design. There are 2 program analysis, MATLAB and Crystal Ball which total load is 11602456,667 kg and width of area 1026,930 m^2. CPT-Test data is analyzed using statistics method to obtain frequency of distribution and statistics parameter such as *Mean, Standard Deviation, coefficient of variation.* The value of q_c as variable to calculate raft foundation and results the value of Chi-Square (x^2) that make 4 type of distribution, normal distribution, gamma, beta and log-normal.

The result of MATLAB program analysis can be seen that for q_c at point 1 (S1), 2 (S2), 3 (S3) and 4 (S4) the distribution value that represent is Normal and at all point that combined the distribution value that represent is Normal. The result of analysis program of MATLAB 7.0 can be seen that the result for best fit distribution at all point and combined all point < x^2 (0.05 ; 3) (11,071). The result of Crystal Ball program analysis by level of confidence 90% - 95% value of SF is 1,5 or more than it and it is used for structural design for raft foundation. The result of structural design of raft foundation which the thickness of mat is 1,26 m. The determination of reinforcement for coordinate *x* and *y* axis, for area at sphere is used D25-140 and for area at pillar is used D25-140 as main bar and D25-190 as prop bar.

Keyword: CPT-Test, Raft Foundation, MATLAB, Crystal Ball, Structural Design